

CLAIMS

What is claimed is:

1. An article comprising a composition consisting essentially of, in weight percent, from about 4 to about 12 percent cobalt, from about 3.5 to about 7 percent tungsten, from about 2 to about 9 percent chromium, from about 0.5 to about 4.5 percent tantalum, from about 5.5 to about 7.5 percent aluminum, from 5 0 to about 5.5 percent rhenium, from about 0.1 to about 1.2 percent titanium, from 0 to about 3 percent molybdenum, from 0 to about 3 percent ruthenium, from about 0.5 to about 2 percent columbium, about 0.01 percent maximum boron, about 0.07 percent maximum carbon, from about 0.3 to about 1 percent hafnium, about 0.01 percent maximum zirconium, about 0.03 percent maximum yttrium, 10 from 0 to about 0.5 percent vanadium, about 0.01 percent maximum cerium, and about 0.01 percent maximum lanthanum, balance nickel and impurity elements.
2. The article of claim 1, wherein the article includes from about 3.0 to about 4.0 percent tantalum.
3. The article of claim 1, wherein the article includes from about 3.0 to about 4.0 percent tantalum, from about 0.2 to about 0.4 percent titanium, from about 0.5 to about 0.7 percent hafnium, and from about 1 to about 2 percent columbium.
4. The article of claim 1, wherein the article includes from about 6 to about 12 percent cobalt, from about 4.5 to about 6.5 percent tungsten, from about 5.5 to about 6.5 percent chromium, from about 3.0 to about 4 percent tantalum, from about 5.8 to about 6.3 percent aluminum, from about 2.8 to about 3.5 percent 5 rhenium, from about 0.2 to about 0.4 percent titanium, from about 1.3 to about 1.7 percent molybdenum, from about 0.5 to about 0.7 percent hafnium, and from about 1 to about 2 percent columbium.

5. The article of claim 1, wherein the article includes from about 7 to about 10 percent cobalt, from about 6 to about 6.3 percent tungsten, about 6 percent chromium, from about 3.1. to about 3.5 percent tantalum, from about 5.9 to about 6.3 percent aluminum, about 0.3 percent titanium, about 0.6 percent hafnium, about 3 percent rhenium, about 1.5 percent molybdenum, and about 1.5 percent columbium.

6. The article of claim 1, wherein the article is substantially a single crystal.

7. The article of claim 1, wherein the article is a directionally oriented polycrystal.

8. The article of claim 1, wherein the article is shaped as a component of a gas turbine engine.

9. The article of claim 1, wherein the article is shaped as a gas turbine blade.

10. A composition of matter consisting essentially of, in weight percent, from about 4 to about 12 percent cobalt, from about 3.5 to about 7 percent tungsten, from about 2 to about 9 percent chromium, from about 0.5 to about 4.5 percent tantalum, from about 5.5 to about 7.5 percent aluminum, from 0 to about 5.5 percent rhenium, from about 0.1 to about 1.2 percent titanium, from 0 to about 3 percent molybdenum, from 0 to about 3 percent ruthenium, from about 0.5 to about 2 percent columbium, about 0.01 percent maximum boron, about 0.07 percent maximum carbon, from about 0.3 to about 1 percent hafnium, about 0.01 percent maximum zirconium, about 0.03 percent maximum yttrium, from 0 to about 0.5 percent vanadium, about 0.01 percent maximum cerium, and about 0.01 percent maximum lanthanum, balance nickel and impurity elements.

11. The composition of matter of claim 10, wherein the composition of

matter includes from about 3.0 to about 4.0 percent tantalum.

12. The composition of matter of claim 10, wherein the composition of matter includes from about 3.0 to about 4.0 percent tantalum, from about 0.2 to about 0.4 percent titanium, from about 0.5 to about 0.7 percent hafnium, and from about 1 to about 2 percent columbium.

13. The composition of matter of claim 10, wherein the composition of matter includes from about 6 to about 12 percent cobalt, from about 4.5 to about 6.5 percent tungsten, from about 5.5 to about 6.5 percent chromium, from about 3.0 to about 4 percent tantalum, from about 5.8 to about 6.3 percent aluminum, from about 2.8 to about 3.5 percent rhenium, from about 0.2 to about 0.4 percent titanium, from about 1.3 to about 1.7 percent molybdenum, from about 0.5 to about 0.7 percent hafnium, and from about 1 to about 2 percent columbium.

14. The composition of matter of claim 10, wherein the composition of matter includes from about 7 to about 10 percent cobalt, from about 6 to about 6.3 percent tungsten, about 6 percent chromium, from about 3.1 to about 3.5 percent tantalum, from about 5.9 to about 6.3 percent aluminum, about 0.3 percent titanium, about 0.6 percent hafnium, about 3 percent rhenium, about 1.5 percent molybdenum, and about 1.5 percent columbium.

15. A method for selecting a reduced-cost nickel-base superalloy, the method comprising the steps of

identifying a baseline nickel-base superalloy having a nominal composition, in weight percent, comprising

a baseline tantalum content of more than about 5 weight percent tantalum, and

a baseline sum (hafnium content plus columbium content plus titanium content plus tungsten content), in weight percent,

selecting a modified nickel-base superalloy having a nominal composition,

in weight percent, comprising

a modified tantalum content at least 1.5 weight percent less than the baseline tantalum content, and

15 a modified baseline sum of (modified hafnium content plus modified columbium content plus modified titanium content plus modified tungsten content) at least 1.5 weight percent greater than the baseline sum.

16. The method of claim 15, wherein the step of selecting includes the step of

5 selecting an absolute value of (the modified baseline sum minus the baseline sum) to be at least as great as the absolute value of (the modified tantalum content minus the baseline tantalum content).

17. The method of claim 15, wherein the step of selecting includes the step of

5 selecting the modified nickel-base superalloy to have a nonzero modified hafnium content, a nonzero modified columbium content, a nonzero modified titanium content, and a nonzero modified tungsten content.

18. The method of claim 15, wherein the sum of the modified tungsten content plus a modified molybdenum content in the modified nickel-base superalloy is at least about 6.5 weight percent.

19. A method for selecting a reduced-cost nickel-base superalloy, the method comprising the steps of

5 identifying a baseline nickel-base superalloy having a nominal composition, in weight percent, comprising
a baseline tantalum content of more than about 5 weight percent tantalum, and

a baseline sum (baseline hafnium content plus baseline columbium content plus baseline titanium content plus baseline tungsten content), in weight percent,

10 selecting a modified nickel-base superalloy having a nominal composition,

in weight percent, comprising

a modified tantalum content at least 1.5 weight percent less than the baseline tantalum content, and

15 a modified baseline sum of (modified hafnium content plus modified columbium content plus modified titanium content plus modified tungsten content) at least 1.5 weight percent greater than the baseline sum, wherein

an absolute value of (the modified baseline sum minus the baseline sum) is at least as great as the absolute value of (the modified tantalum content minus the baseline
20 tantalum content),

wherein the modified nickel-base superalloy has a nonzero modified hafnium content, a nonzero modified columbium content, a nonzero modified titanium content, and a nonzero modified tungsten content, and

wherein the sum of the modified tungsten content plus a modified molybdenum
25 content in the modified nickel-base superalloy is at least about 6.5 weight percent.